Effect of strip tillage, residue mulching and weeding regimes on yield performance of T. *aman* rice

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Introduction

Development of efficient farm machinery and availability of effective herbicides have resulted the higher profitability in conservation agriculture (CA) that in turn has been identified as an effective tool for sustainability of agriculture (Farooq *et al.,* 2011). But weed species shifts and losses in crop yield caused from increased weed density have been cited as major hurdles of CA adoption (Dahal and Karki, 2014). Crop yields in CA can be similar to conventional systems if weeds are controlled (Chauhan *et al.*, 2012). The availability of pre-plant, pre-emergence and post-emergence herbicides provides an opportunity to control weeds in CA. But weed control strategies adopted must reduce the development of herbicide resistance by weeds. The presence of crop residues on the soil surface may reduce weed infestation by affecting weed seed germination and emergence patterns. Considering the above facts, this on-farm experiment was conducted to examine the performance of strip tillage, residue mulching and weeding regimes on crop yield and weeds.

Materials and methods

The on-farm experiment was conducted at the Durbacahra village under Gouripur upazila of Mymensingh district of Bangladesh from 04 July to 27 September 2014. Hybrid rice cv. *Hybrid Krishan2*, was transplanted with 6 tillage and weed control practices *viz*., Conventional tillage (CT) + 3 hand weeding (HW) (Control); glyphosate (Gly) + Strip tillage (ST)+1 HW; Gly+ ST + Pre-emergence herbicide (PE) (Pendimethalin); Gly+ ST + Post-emergence herbicide (PO) (Ethoxysulfuron); Gly+ ST + PE + PO; Gly+ ST + weed-free (6 HW), and 2 levels of crop residue *viz.*, farmers' practice (No residue) and increased retention (50% residue). The design was RCBD with four replications. Conventional tillage was done with 2-wheel power tiller (2WPT) and ST with Versatile Multi-crop Planter (VMP). Weed species number, total weed plant numbers and dry weight were recorded randomly from 1 m^2 area of each plot at 25, 45, 65 days after transplanting (DAT) and at crop harvest. The rice crop was harvested at maturity for grain yield. Data were subjected to ANOVA using *STATISTIX* program.

Result and discussion

Weed species identified in the T. aman rice field

The experimental plots were infested with 21 weed species belonging to 11 families (Table 1). Five species belonged to Cyperaceae, three to Poaceae, two to each of Amaranthaceae, Asteraceae, Pontederiaceae, Onagraceae and each one of rest of the five families. Broadleaves (62%) were dominant over sedges (24%) and grasses (14%) while annuals (71%) were outnumbered than perennials (21%).

Effect of tillage, residue mulching and weeding regimes on weed and crop

CT produced the highest weed biomass compared to ST at all times except at 25 DAT. Compared to glyphosate alone, PE reduced the weed biomass by 15-32% while the PO reduced 20-50% and combination of PE and PO reduced weed biomass by 52-70%. Retention of 50% residue reduced weed biomass by about 20 -38% compared to no-residue level. CT+3HW yielded the lowest grain which was identical to ST with glyphosate and 1 HW (Table 2). ST kept weed free yielded the highest grain which was 25% higher compared to CT+1HW. ST with PE and PO yielded about 13% higher grain over CT+1HW and ST with glyphosate+ 1HW. ST with PE and ST with PO yielded the same grains but 3 and 6 % higher, respectively over CT. Among the treatment combinations, 50% residue resulted 4% higher grain over no-residue. The highest BCR was calculated from ST with PE and PO which was 19% higher than ST kept weed free but 160% higher than CT (Table 2). ST with PE and ST with PO had identical BCR which was about 90% higher than CT. ST with glyphosate and 1 HW earned 80% higher BCR over CT while CT earned lowest BCR. Among the treatment combinations 50% residue earned around 10% higher BCR over no-residue.

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References

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Table 1. Weed species recorded from T. aman rice field (Weed morphology and life cycle in parenthesis- B= Broadleaf, G=Grass, S=Sedge, A=Annul, P=Perennial)

Scientific name	Family	Scientific name	Family
Sagittaria guyanensis (B, A)	Alismataceae	*Fimbristylis miliaceae* (S, A)	Cyperaceae
Alternanthera sessilis (B, P)	Amaranthaceae	*Echinochloa crussgalli* (G, A)	Poaceae
A. philoxeroides (B, P)	Amaranthaceae	*E. colonum* (G, A)	Poaceae
Pistia stratiotes (B, P)	Araceae	*Paspalum distichum* (G, P)	Poaceae
Eclipta alba (B, A)	Asteraceae	*Monochoria hastate* (B, A)	Pontederiaceae
Enhydra fluctuens (B, A)	Asteraceae	*M. vaginalis* (B, A)	Pontederiaceae
Cyanotis axillaris (B, A)	Commelinaceae	*Polygonum coccineum* (B, P)	Polygonaceae
Cyperus difformis (S, A)	Cyperaceae	*Jussiaea repens* (B, A)	Onagraceae
C. compressus (S, A)	Cyperaceae	*J. decurrens* (B, A)	Onagraceae
C. nemoralis (S, P)	Cyperaceae	*Oxalis europea* (B, A)	Oxalidaceae
Scirpus mucronatus (S, A)	Cyperaceae		

Table 2. Effect of tillage, residue mulching and weeding regimes on weed and rice yield and benefit cost ratio (BCR).

Tillage and Weeding regimes	Residue	Weed biomass (g m^{-2}) at				Yield (t ha^{-1})	BCR
		25 DAT	45 DAT	65 DAT	Crop harvest		
CT+3 HW	No	52b	58a	35a	19	5.17gh	0.63g
	50%	46bc	50b	27b	10	5.20g	0.76g
Gly+ST+1 HW	No	77a	52b	29b	11	5.18g	1.15f
	50%	47bc	42c	19c	10	5.27f	1.33e
Gly+ST+PE	No	39cd	40cd	17cd	9	5.41e	1.24e
	50%	29de	37de	15cde	6	5.52d	1.36de
Gly+ST+PO	No	43bc	36de	13def	10	5.43e	1.25e
	50%	40cd	32e	11efg	6	5.56d	1.39de
Gly+ST+PE+PO	No	39cd	28f	10fg	5	5.47c	1.69b
	50%	30de	14g	7g	2	6.27b	1.90a
Gly+ST+WF (6 HW)	No	0	0	0	0	6.36b	1.42c
	50%	0	0	0	0	6.56a	1.61b
Significance		*	**	*	NS	**	**
$LSD_{0.05}$		13.6	4.7	4.4	7.6	0.32	0.18